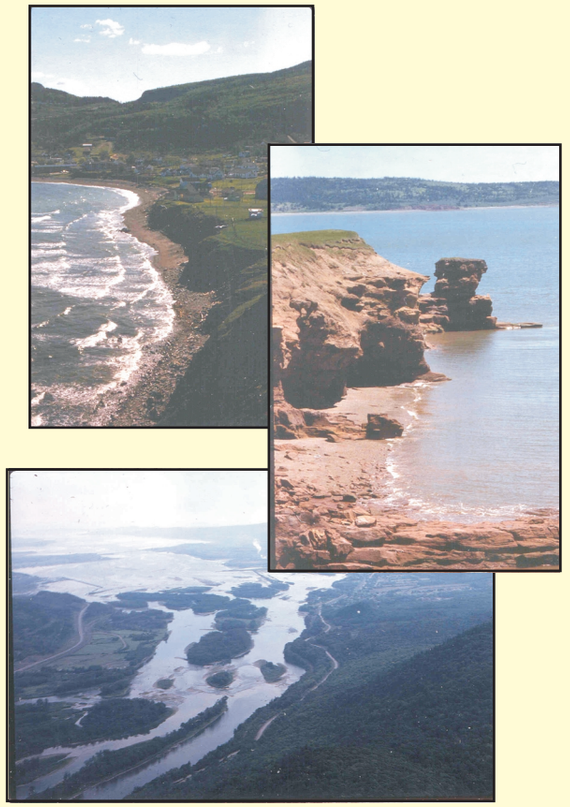

The Checklist

Geoindicators have been compiled in a standard format to enable ready selection and application. The Format Summary describes the 16 fields listed for each indicator.

The complete list was published in 1996, together with a series of background papers, under the title "Geoindicators: Assessing Rapid Environmental Change in Earth Systems" edited by A.R. Berger and W.J.Iams (Rotterdam: A.A. Balkema, 466 p). The complete checklist is available free of charge through the Internet at:

http://www.gcrio.org/geo/title

FORMAT SUMMARY FOR GEOINDICATOR CHECKLIST

Name
Of indicator.

Brief Description
How does it relate to geological processes and phenomena?

Significance
Why should it be monitored?

Human or natural cause
Usefulness in distinguishing natural from anthropogenic change.

Environment where applicable
General landscape setting.

Types of monitoring sites
Specific locations for monitoring.

Spatial scale
Over what area would monitoring take place?

Method of Measurement
Field and laboratory techniques.

Frequency of Measurement
How often should monitoring be done?

Limitations of data/monitoring
What difficulties exist in gathering data and useful results?

Applications to past and future
Predictive potential and usefulness for paleonenvironmental studies.

Possible thresholds
Beyond which significant change in environments may occur.

Key references
Practical manuals and key publications.

Other information sources
Organizations and programs.

Related issues
Regarding other environmental and geological processes.

Overall assessment
Importance for environmental monitoring and sustainability.

Geoindicators Can Be Used For:

- Assessing conditions of terrestrial and coastal environments on a wide range of spatial scales, from local to global.
- Answering the questions:
  - What is happening in the environment?
  - Why is it happening?
  - Why is it significant?
  - What are we doing about it?
- Establishing baseline conditions and trends from past environments, so that human-induced and natural stresses can be better understood.

Geoindicators can be applied in urban and non-urban areas to determine important landscape changes in a way which can be reported in simple terms to planners and decision-makers.

They can assist in ecosystem monitoring, environmental impact assessments, determining forest renewal practices, and baseline surveys required for planning mining, land use changes, and construction of reservoirs, roads, canals, river diversion, and other construction projects.

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COGEOENVIRONMENT
Commission on Geological Sciences for Environmental Planning

Introducing

GEOINDICATORS

Tools for Assessing Rapid Changes in Earth Systems

The International Union of Geological Sciences has developed a new approach to landscape indicators, to assist in environmental research, monitoring and reporting.

What Are Geoindicators?

Geoindicators are measures (magnitudes, frequencies, rates, trends) of geological processes and phenomena, occuring at or near the Earth's surface and subject to changes that are significant for understanding environmental change over periods of 100 years or less.

Geoindicators assess both catastrophic events, and those that are more gradual, but evident within a human lifespan.

They describe processes that are capable of changing without human interference, though there are many ways in which human actions can accelerate, slow or divert natural changes.

Geoindicators have been developed from standard approaches and techniques in geology, geochemistry, geomorphology, geophysics, hydrology and other earth sciences. Some are complex and costly to monitor, but many are relatively simple and inexpensive to apply.

They focus on abiotic components of ecosystems and landscapes. However, many interact with biological systems in time and space, so that it is not possible to draw a

Geoindicators and Some Environmental Changes They Reflect

Coral Chemistry and Growth Patterns
Surface water temperature, salinity

Desert Surface Crusts and Fissures
Aridity

Dune Formation and Reactivation
Wind speed and direction, moisture, aridity, sediment availability

Dust Storm Magnitude, Duration and Frequency
Dust transport, aridification, land use

Frozen Ground Activity
Hydrology, downslope movement (especially in the active layer)

Glacier Fluctuations
Precipitation, insolation, melt runoff

Groundwater Chemistry in the Unsaturated Zone
Weathering, land use

Groundwater Level
Abstraction and recharge

Groundwater Quality
Industrial, agricultural and urban pollution, rock and soil weathering, land use, acid precipitation, radioactivity

Karst Activity
Groundwater chemistry and flow, vegetation cover, fluvial processes

Lake Levels and Salinity
Land use, streamflow, groundwater flow

Relative Sea Level
Coastal subsidence and uplift, fluid withdrawal, sedimentation and compaction

Sediment Sequence and Composition
Land use, erosion and deposition

Seismicity
Natural and human-induced release of earth stresses

Shoreline Position
Coastal erosion, land use, sea levels, sediment transport and deposition

Slope Failure - Landslides
Slope stability, mass movement, land use

Soil and Sediment Erosion
Surface runoff, wind, land use

Soil Quality
Land use, chemical, biological and physical soil processes

Streamflow
Precipitation, basin discharge, land use

Stream Channel Morphology
Sediment load, flow rates, climate, land use, surface displacement

Stream Sediment Storage and Load
Sediment transport, flow rates, land use, basin discharge

Subsurface Temperature Regime
Heat flow, land use, vegetation cover

Surface Displacement
Land uplift and subsidence, faulting, fluid extraction

Surface Water Quality
Land use, water-soil-rock interactions, flow rates

Volcanic Unrest
Near-surface movement of magma, heat flow, magmatic degassing

Wetlands Extent, Structure, and Hydrology
Land use, biological productivity, streamflow

Wind Erosion
Land use, vegetation cover

Dec 1999

Selecting Geoindicators

From a wide range of possible geoindicators, twenty-seven have been selected to describe the most important, common, short-term changes in various landscapes and geological settings. Some geoindicators, such as shoreline position, are single parameters. Others, such as frozen ground activity and groundwater quality, are aggregates of several measures.

Geoindicators relate to earth systems, and it should be recognized that there are many interactions, for example, between surface and groundwater, and between steam sediment load and discharge, streamflow, and soil and sediment erosion. Few geoindicators are, therefore, independent variables.